TECHNICAL ADVISORY GROUP ISSUE SUMMARY
ACTIVATED CARBON INJECTION

Background

Activated carbon injection (AC injection) is the focus of many discussions for controlling mercury emissions as it appears as a primary control technology with widespread applicability and projected near term availability. The concept is to inject activated carbon into the flue gas stream exiting the boiler and agglomerate / absorb the mercury onto particulate matter that is then removed in existing particulate control equipment. A full-scale test at the WEPCO Pleasant Prairie Power Plant showed mercury could be successfully captured using AC injection. However, the increased carbon levels in flyash are expected to negatively affect the beneficial use of the flyash material (e.g. concrete). This could result in increase costs for landfill disposal of the mercury containing flyash and loss of by-product revenue sales.

Key Points

- There has been considerable testing of AC injection and models have been developed to evaluate its application to different firing configurations. Two full-scale tests, one for sub-bituminous coal / electrostatic precipitator (ESP) and one for bituminous coal / fabric filter baghouse (FF), have demonstrated that AC injection will work. However, these tests also demonstrated that further full-scale long term testing is needed to determine the range of capabilities and limitations that will occur.

- AC injection will be more effective on bituminous coal than sub-bituminous coal, due to the fact that sub-bituminous coal emits greater amounts of elemental mercury that is more difficult to control. Wisconsin utilities use sub-bituminous coal to minimize sulfur dioxide emissions. Fuel switching to bituminous coal to achieve better mercury control with AC injection would also require additional costs because of the need for sulfur dioxide control equipment.

- The Electric Power Research Institute believes that activated carbon injection is 3 to 5 years from commercial application for coal-fired utility boilers.

- Two approaches have been identified as technically feasible for the use of AC injection on Wisconsin utility boilers.
  1) AC injection prior to the existing particulate matter control equipment (electrostatic precipitator (ESP) or fabric filter (FF).
  2) AC injection after the existing particulate matter control equipment, but prior to a newly installed *compact* fabric filter.

- A full-scale test of AC injection at WEPCO's Pleasant Prairie Power Plant, the first approach, resulted in maximum mercury emission reductions of 60% to 70%. This plant burns sub-bituminous coal and has a cold side ESP for particulate matter control. Due to an oversized ESP this probably represents a higher reduction level for this type configuration. Consideration of ESP design, duct configuration (residence time) and other conditions should be noted when applying the WEPCO results to other plants.

- The sub-bituminous / ESP cold side configuration at Pleasant Prairie is a more difficult to control configuration than other control configurations in the state. This assumes that the hot side ESP units in Wisconsin are converted to a cold side ESP configuration (added cost). The potential for hotside conversion has not been assessed and may not be possible at all Wisconsin units.

- The Gaston (Alabama) full-scale testing of AC injection prior to a compact fabric filter, the second approach, showed sustained reductions of 80%, but the amount of AC injection was limited because of the size of the compact fabric filter used in the test. A newly installed fabric filter baghouse designed for AC injection has the potential to achieve 90% or greater reductions.

- The long-term impacts of AC injection prior to an ESP or FF have not been determined. However, it is possible that both control equipment life and equipment control efficiency may be reduced. Using a compact FF with AC injection, the second approach, would likely minimize these expected impacts through proper design for AC injection.

- AC injection prior to an ESP or FF will result in all flyash containing the activated carbon - mercury material. This likely renders the flyash unusable for cement manufacture and would likely mean landfill disposal of this material. Flyash treatment alternatives may be viable but have not been fully assessed at this time. All of the major utilities in Wisconsin reuse significant portions of their flyash.

- According to USEPA, the second approach minimizes the amount of fly-ash containing mercury to < 5% of total flyash.

- The ultimate fate of mercury captured by carbon is undetermined at this time. USEPA has indicated that the potential release from landfilling or reuse in applications such as gypsum board manufacturing is expected to be minimal, but further research has been initiated to make this determination.

- USEPA is projecting that AC injection control efficiencies will increase through the use of contacting beds. In addition, other sorbent materials that can use the same injection equipment but do not affect re-use or landfilling are being developed to replace activated carbon. None of these materials have undergone full-scale testing and thus may not be available prior to a 5-year horizon in consideration for widespread implementation.

- The initial WDNR estimate for mercury removal costs using AC injection did not consider the fly-ash impacts, increased energy consumption, and other potential plant impacts that would tend to increase costs. The estimate also did not consider the likely decrease in cost for activated carbon under mature market conditions.